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Andomyces coronatus gen. & sp. nov. from Thailand

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Abstract—A new genus and species, *Andomyces coronatus*, found on submerged decaying wood from freshwater habitat in Thailand, is described and compared with similar genera such as *Polyschema*, *Torula,* and *Acrophragmis*. The new dematiaceous genus is morphologically characterized by micronematous conidiophores; globose to subglobose, discrete, smooth, conidiogenous cells; schizolytic conidial secession; and didymosporous, distoseptate, smooth conidia. The distinguishing features of the new species are provided in the description and illustrations.

Key words—asexual fungi, hyphomycetes

Introduction

During surveys of hyphomycetes conducted in freshwater streams in Thailand during 2013-15 (Chuaseeharonnachai & al. 2014), an unusual dematiaceous hyphomycete was found on submerged woody materials at a waterfall. The fungus possessed a combination of morphological features that did not fit any described dematiaceous hyphomycete genera (Matsushima 1980, 1985, 2001; Ellis 1971, 1976; Wu & Zhuang 2005; Castañeda Ruíz & al. 2009; Seifert & al. 2011; Crous & al. 2015; Li & al. 2017). We accordingly propose a new genus and species, *Andomyces coronatus,* based on morphological data.

Materials & methods

Fresh specimens were collected from the riverbank of a waterfall, located in Pak Chong District, Nakhon Ratchasima Province (14.43°N 101.37°E). Fungal specimens were brought to the laboratory in Ziplock plastic bags and incubated in plastic boxes lined with moistened tissue papers at room temperature (22-25 °C) for 2 weeks. Specimens were examined for fungal colonies with an Olympus SZ61 stereomicroscope. Fungal structures were picked up and transferred using a sterile fine-tipped needle to a drop of distilled water on a glass slide and covered by a coverslip. The fungal features were examined under an Olympus CX31 compound microscope and photographed using an Olympus DP70 differential interference contrast microscope. The characteristic features of asexual morph ascomycetes were observed and measured under a scaled microscope. Isolation was attempted on various media (Difco™: potato dextrose agar, corn meal agar and malt extract agar; Himedia™: potato carrot agar) and incubated at room temperature (22-25 °C), but no conidial germination was observed and therefore the fungus could not be cultured. The type specimen is deposited at Fungarium Biotec Bangkok Herbarium (BBH), Thailand (https://www.nbt-microbe.org/fungarium).

Taxonomy

Andomyces Chuaseehar., Sri-indr. & Somrith., **gen. nov.**

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Differs from *Polyschema, Torula,* and *Acrophragmis* in having micronematous, cylindrical conidiophores, globose to subglobose conidiogenous cells, and distoseptate conidia.

Type species: *Andomyces coronatus* Chuaseehar. & al.

Etymology: referring to Professor Dr. Katsuhiko Ando, in recognition for his significant contributions to freshwater mycology and-*myces:* referring to fungi.

Colonies on natural substrate, loosely confluent, punctiform, pulvinate, blackish brown to black. Mycelium in the substrate composed of septate, branched, smooth or verrucose, brown hyphae. Conidiophores micronematous, mononematous, cylindrical, branched, smooth or verrucose. Conidiogenous cells monoblastic, discrete, terminal, determinate, globose to subglobose, smooth or verrucose. Conidial secession schizolytic. Conidia holoblastic, acrogenous, solitary, didymosporous, distoseptate, with globular cell lumen, smooth or verrucose, thick walled, with the median part bearing a circle of knobs on the cell wall when mature.

Sexual morph: unknown.

Andomyces coronatus Chuaseehar., Sri-indr. & Somrith., **sp. nov.** Figs 1, 2

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Differs from *Acrophragmis* spp. by its micronematous, cylindrical conidiophores, its globose to subglobose conidiogenous cells, and its distoseptate conidia.

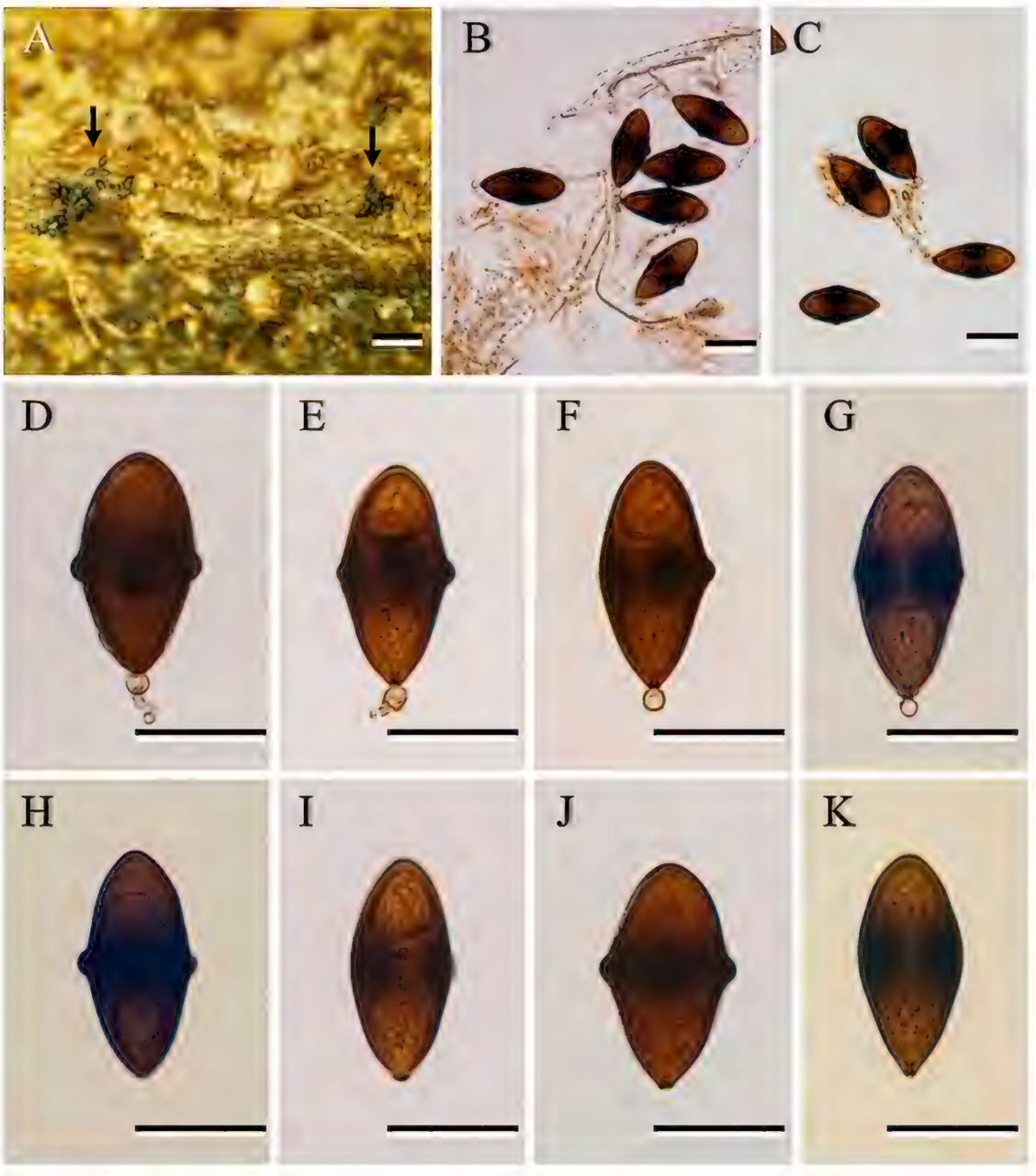

Fig. 1. *Andomyces coronatus* (holotype, BBH40836). A. Colonies scattered on submerged decaying wood, arrowed; B, C. Squash mount of a portion of colonies showing conidiophores, conidiogenous cells, and conidia; D–G. Conidia with conidiogenous cells; H–K. Conidia. Scale bars = 25 μm.

Type: Thailand, Nakhon Ratchasima Province, Pak Chong District, 14.43°N 101.37°E, c. 740 m a.s.l., on unidentified submerged decaying wood, 1 November 2014, C. Chuaseeharonnachai (**Holotype:** BBH 40836).

Etymology: *coronatus*, referring to the conidia, which are shaped like a crown.

Culture: not obtained. Colonies on natural substratum, loosely confluent, punctiform, pulvinate, blackish brown to black. Mycelium partly superficial and partly immersed in the substrate, composed of branched, septate, smooth walled, pale brown to brown, thick walled, 2–2.5 µm wide hyphae. Conidiophores micronematous, mononematous, cylindrical, branched, 1–6-septate, smooth to rough walled, hyaline to pale brown, ≤175 µm long, 1.5–2.5 µm wide; mostly 30–55 × 2–2.5 µm. Conidiogenous cells monoblastic, discrete, terminal, determinate, globose to subglobose, smooth walled, hyaline to pale brown, 3.75–5 µm diam. $x = 4.77$ µm; $n = 30$). Conidial secession schizolytic. Conidia holoblastic, acrogenous, solitary, dry, biconic, 1-distoseptate, with large cell lumen (10–12.5 × 3.75–5 µm) connecting between proximal and distal cells, smooth walled, brown to dark brown, with the blackish-brown to black median part, projecting a circle of equidistant 4-5 hemispherical knobs (5 µm wide, 2.5 µm thick) when mature, 40–47 µm long, 20–27.5 µm wide at the broadest part ($x = 43.6 \times 24.7$ µm; $n = 40$), rounded at apex, subulate basal cell with a circular scar at the base on secession. Globose conidiogenous cells often remain attached to basal point of detached conidia.

Sexual morph: unknown.

Discussion

On its natural substrate, *Andomyces coronatus* produces groups of black conidia that may resemble those of several genera, such as *Conioscypha, Parafuscosporella, Vanakripa,* or *Fuscosporella*. However, these genera have euseptate conidia, whereas *A. coronatus* has distoseptate conidia. The distoseptum of *A. coronatus* is thick with the type of septal pore (Figs 1G, 2G) noted by Ho & Hyde (2004). Septal types (distoseptum vs euseptum) are helpful in separating several genera, such as *Corynespora* vs *Solicorynespora* and *Podosporiopsis* vs *Podosporium* (Ma & al. 2016). Anamorphic fungi with black distoseptate conidia are uncommon, clearly distinguishing *A. coronatus* from any previously described taxon.

Andomyces is morphologically most similar to *Polyschema* H.P. Upadhyay, *Torula* Pers., and *Acrophragmis* Kiffer & Reisinger in producing dark brown to black colonies, superficial or immersed pale brown to brown mycelia, and darkened conidia (Persoon 1795, Upadhyay 1966; Ellis 1976, Wu & Zhuang 2005, Seifert & al. 2011, Crous & al. 2015).

The conidia of *Andomyces coronatus* are superficially similar to *Acrophragmis* in having a ring of small protuberant knobs on the conidial

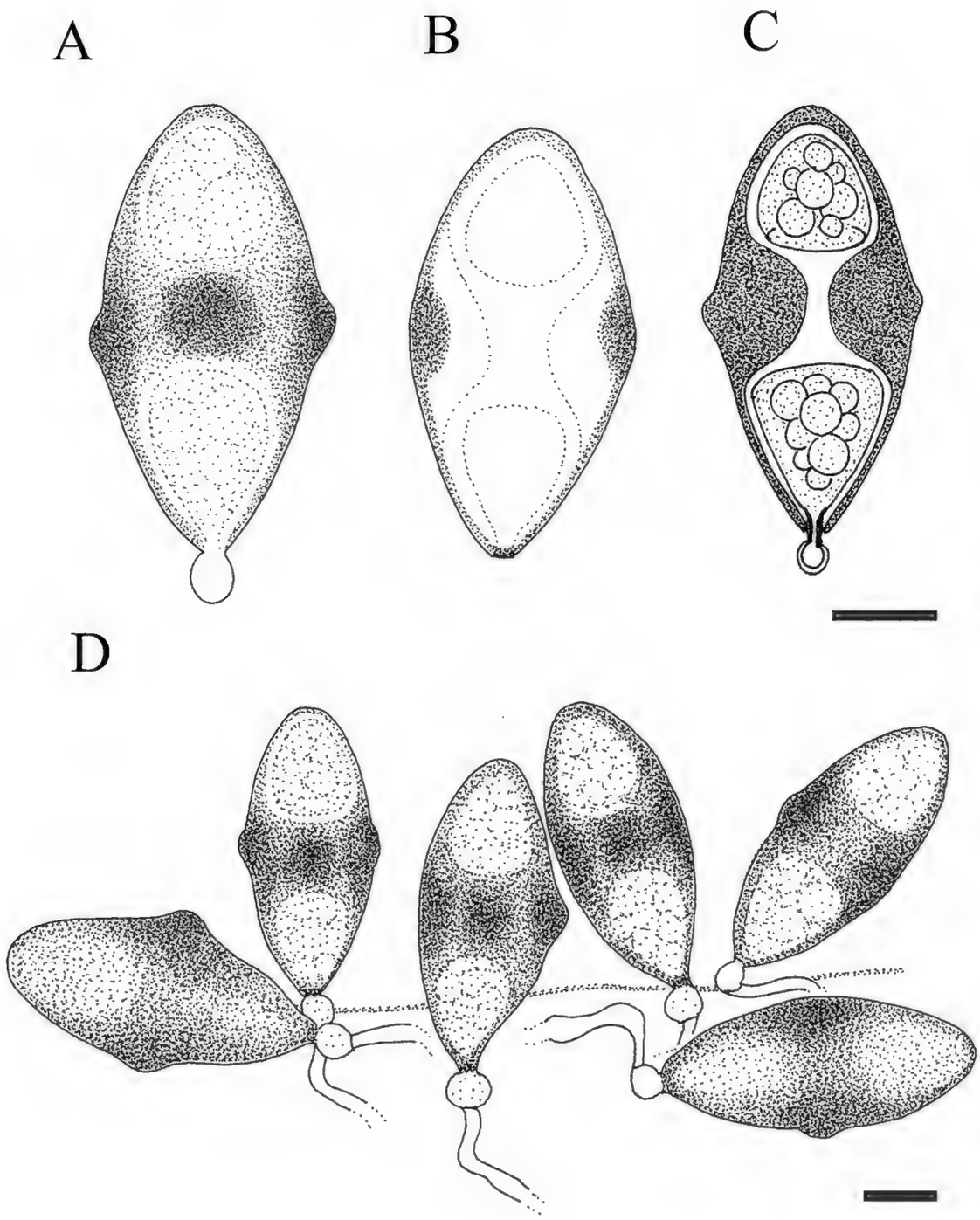

Fig. 2. *Andomyces coronatus* (holotype, BBH40836).
A, B. Outside view of conidia; C. Conidial cross section showing the cell lumen that connects the proximal and distal cells; D. Colonies on natural submerged decaying wood.
Scale bars = 10 μm. Artist: Sayanh Somrithipol.

Table 1. Comparative morphological characters of *Andomyces* and closely related anamorphic genera.

Character	*Polyschema*[1]	*Torula*	*Acrophragmis*	*Andomyces*
Colony	Flattened, floccose, woolly; dark-green, brown to dark brown, or greenish black; sporulating abundantly.	Discrete, effuse, dry, velvety; dark brown to black	Effuse, often inconspicuous; hairy; brown	Loosely confluent, punctiform, pulvinate; blackish-brown to black.
Conidiophore	Present or absent, short or long, decumbent, micronematous, mononematous, simple, peg-like, torulose, cylindrical at the base, wider toward the apex, arising laterally from the hyphae, olivaceous or pale brown, 0–3-septate.	Macro/micronematous, often reduced to conidiogenous cells, or with one brown supporting cell, verrucose, mononematous, brown.	Macronematous, mononematous, single or aggregated at the base, unbranched, pale brown to dark brown, with percurrent proliferations.	Micronematous, mononematous, cylindrical, branched or unbranched, smooth or verrucose.
Conidiogenous cells	Produced on repent hyphae or conidiophores, singly and form conidium through isthmus or without isthmus, pale brown to brown.	Solitary on mycelium, erect, doliiform to ellipsoid or clavate, brown, smooth to verruculose, mono- to polyblastic.	Integrated, terminal, holoblastic, cylindrical, smooth, pale brown to brown, percurrent.	Monoblastic, discrete, terminal, determinate, globose to subglobose, smooth or verrucose.
Conidial septa	Euseptate	Euseptate	Euseptate	Distoseptate
Conidia	Didymosporous phragmosporous, or muriform, brown, single, dry.	Phragmosporous, monilioid, brown, in acropetal branched chains, dry.	Phragmo- or staurosporous, central cell dark, polar cells hyaline, multiple protuberances, single, dry.	Didymosporous or occasionally phragmosporous, holoblastic, acrogenous, solitary, smooth or verrucose, with the median part bearing, equidistant, 4–5 protuberant knobs on the surface.
Substratum	Soil, wood, litter	Decaying wood	Dead branches of woody plant	Submerged decaying wood

[1] described based on agar media

cell wall. However, the new species possesses micronematous, cylindrical conidiophores, globose to subglobose conidiogenous cells, and distoseptate conidia, whereas *Acrophragmis* is characterized by macronematous, long stalked conidiophores, integrated, percurrent conidiogenous cells, and acrogenous solitary oblong to cylindrical 3-euseptate conidia (Kiffer & Reisinger 1970, Ellis 1976, Rao & de Hoog 1986, Seifert & al. 2011).

Andomyces coronatus differs from *Polyschema* species in having branched or unbranched cylindrical conidiophores, monoblastic conidiogenous cells, and holoblastic, distoseptate conidia (Figs 1A–C, 2D). In contrast, *Polyschema* has conspicuous or undifferentiated conidiophores, mono- or polytretic globose to slightly clavate conidiogenous cells, and distinct euseptate conidia (Upadhyay 1966; Ellis 1976; Reisinger & Kiffer 1974; Pandeya & Saksena 1978; Castañeda-Ruíz & al. 1996, 2000; Seifert & al. 2011).

Torula and related genera—*Rutola* J.L. Crane & Schokn. and *Latorua* Crous—can be distinguished from *Andomyces coronatus* by the morphology of their conidiophores which are reduced to conidiogenous cells, as well as the presence of supporting cells or the conidial chains composed of brown blastic doliiform to ellipsoidal conidiogenous cells (Persoon 1795, Ellis 1971, Crane & Schoknecht 1977, Matsushima 1980, Seifert & al. 2011, Crous & al. 2015, Su & al. 2016, Li & al. 2017). In contrast, *A. coronatus* conidia characteristically have a cell lumen that connects the proximal and distal cells and a conidiogenous cell that often remains adhered to the basal attachment point. (Fig. 2B, C). The diagnostic characteristics of the genera discussed above are summarized in Table 1.

Even lacking cultural characters and molecular sequence data, the morphology of this fungus is sufficiently unique to warrant a new genus and a new species. The continued surveys of freshwater fungi in Thailand have provided new information to Thai biodiversity in which up to 600 species have been recorded (Sivichai & Boonyuen 2005). This fungus is an additional record of a novel species in the natural stream habitat, suggesting that other taxa may await discovery.

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